Research project "Terai Arc Landscap (Phase II)"

Project-7

Evaluation of the functional status and quality of corridors connecting fragmented populations of tiger in the Indian part of Terai Arc Landscape

This project is a follow-up of the recent project carried out in the Indian side of Terai Arc Landscape (TAL) by the Wildlife Institute of India supported by Save the Tiger Fund through National Fish and Wildlife Foundation (Johnsingh *et al*., 2004). The proposed project is to evaluate the functional status (use and intensity) and assess the corridor quality in terms of the biological characteristics that facilitate or impede tiger movement between different Tiger Habitat Blocks (THBs) and ensuring in achieving long-term tiger conservation.

Project Abstract

Habitat fragmentation is one of the major threats leading to local extinction of species. Increasing human population, exploitation of natural resources and other infrastructure developmental activities have led to fragmentation of the biologically rich and contiguous habitat in TAL that extends from Yamuna river in the west to Bagmati river in the east. This, along with degradation of habitat poses a major threat to the endangered tiger and other associated wildlife species. Restoring connectivity between the THBs *viz a viz* the fragmented tiger populations is critical to ensure the future of tiger in this Landscape having long term viable population.

The recent study by Wildlife Institute of India (WII) in collaboration with Save the Tiger Fund (STF) and National Fish and Wildlife Foundation (NFWF) has identified ten THBs (nine with tiger and one without) and ten corridors within the Indian part of TAL (Johnsingh *et al*., 2004). However, information about the functional status of these corridors is lacking and undoubtedly, this knowledge is vital for conservation plans ahead. Corridors will be prioritized on the basis of imminent threat of permanent break and lack of information and subsequently taken up for intensive study. This proposal explains the efforts that will be made to assess these corridors in terms of current level of use by tiger, the habitat quality and socioeconomic conditions of the people using the resources from these corridors. Key issues and variables would be identified so that conservation action targeting corridor restoration can be efficient and cost-effective. Transects, track plots and camera-traps, if feasible would be set-up to study the movement of tiger and other associated species. Indices of relative abundance of tiger, prey and disturbance indicators will be developed based on presence/absence data collected from the transects with probability of detection function.. The spatial data generated in the recent project completed by Wildlife Institute of India and nested plots laid on the identified corridors would be used to describe the corridor quality and to assess the factors that are facilitating or impeding the movement of tigers between habitats. The primary and secondary data on human and livestock population would be acquired to quantify the socioeconomic conditions of stakeholders and this would provide insight on the field reality and efforts required for addressing the task of corridor restoration.

Project Need

Tiger habitat in the foothills of Himalaya was once contiguous from the forests west of Yamuna river to the foothills of Arunachal Pradesh (Toovey, 1987). With expanding human populations and agricultural frontiers, increased development and exploitation of natural resources, this tract has gradually fragmented. Species conservation in such fragmented landscapes relies largely on the level of connectivity between the habitat patches. The corridors allow movement of animals between habitat patches or subpopulations and importantly, the gene flow between subpopulations are facilitated (Fahrig and Merriam, 1985; Bennett, 1990; Beier, 1993) thereby preventing extinction of small populations. However, the corridor quality in a landscape is more important than the number of corridors (Taylor *et al*., 1993; Fahrig and Merriam, 1994) and therefore, it is essential to retain a

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network of functional corridors to ensure conservation at local and landscape levels (Harris and Scheck, 1991; Saunders and Hobbs, 1991). The merits of corridors and their structural specifications like width and composition often vary from place to place and also depend on the target species (Beier and Loe, 1992; Pither and Taylor, 1998). As we understand, dispersal of highly sensitive species such as tiger will only occur if corridors contain suitable vegetation structure and seral stage (Tiebout and Anderson, 1997). Hence, it becomes imperative to obtain detailed information on the movement patterns and frequency of use by individual species across the landscape patches along with the spatial and structural arrangements of the corridors so that the corridor value is assessed in the right context (Saunder and Reberia, 1991). But consideration of each and every species in this exercise is severely limited by time and other resource constraints. A useful and practical alternative would then be the "umbrella species" approach, wherein the needs of one or two species are addressed rigorously (Noss, 1991). A large carnivore like tiger is an ideal candidate as umbrella species for corridor assessment and management (Noss, 1991; Beier, 1993).

In the recent study by WII, supported by the STF and NFWF, USA, ten THBs (nine with tiger and one without) and ten corridors have been identified in the Indian part of Terai Arc Landscape (Johnsingh *et al.*, 2004). The functional status (particularly the magnitude of use) and the biophysical parameters that determine corridor use by the tiger are yet to be comprehended at micro distribution scales. Only then, the future survival of tigers in this Landscape could be predicted and conservation action can be initiated on priority. The corridors that have been identified in the Indian part of TAL are as follows (Refer to Map1):

1. Yamuna river corridor, 2. Kansrau–Barkote corridor, 3. Chilla-Motichur corridor 4. Rajaji-Corbett corridor, 5. Kosi river corridor, 6. Nihal-Bhakhra corridor, 7. Gola river corridor, 8. Kilpura–Khatima–Surai corridor, 9. Lagga Bagga–Sukhlaphanta-Tatarganj corridor and 10. Dudhwa–Katerniaghat corridor.

All the corridors in the above Landscape are under varying levels of human disturbance and prey abundance. However, this study would include only those corridors that are having high conservation priority status. Given the need for immediate management intervention on the one hand, and lack of adequate information on these corridors, on the other, the following objectives are addressed in the proposed project.

1. **To describe the functional status (use and intensity) of the corridors with reference to tiger.**
2. **To study the biological characteristics (vegetation composition, prey distribution and abundance, and disturbance status) that determine the corridor quality and use.**
3. **To document the socioeconomic issues affecting the corridor existence and its use.**

Methodology

The following aspects of corridors would be investigated:

1. **Functional status:** The presence/absence data have been widely used in monitoring programs (especially in large scale monitoring programs) (Dzieciolowski, 1976; Kie, 1988) and investigations of metapopulation dynamics (Hanski, 1994; MacKenzie *et al.* 2002). However, nondetection of the species is not equivalent to absence because species may go undetected during survey even when present. So, estimation of detection probability using presence/absence data under this situation is important to make useful inferences about the system under investigation (MacKenzie *et al.* 2002). The functional status of corridors in terms of corridor use and intensity of usage would be established in two ways by recording tiger pugmarks and other

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signs and photographing tiger using remotely triggered cameras (if feasible), in the corridor and surrounds. The presence/absence of signs would be quantified based on track plots and monitoring trails. The trails, generally following existing roads or trails (human and wildlife) and riverbeds would be identified in the field with the help of existing spatial data and administrative maps of the forest department. The trails will be divided into segments with appropriate intervals and signs of tiger and other associated wildlife (particularly prey species) and disturbance indicators (cattle, dog and human) will be recorded in each segment. Indices of relative abundance of tiger, prey and disturbance indicators will be developed based on presence/absence data by calculating the proportion of the sampling segments having these signs (Karanth and Nichols, 2002). The detection probabilities of sites occupied by tiger and prey species will be estimated by collecting presence/absence data from each sampling units (segments of monitoring trails) from multiple samples (MacKenzie *et al.* 2002, 2003). The number of track plots and trails and frequency of sampling would be decided on the basis of corridor size and reconnaissance survey. The abundance of tiger in the corridor area will be estimated from camera-trap data using capture-recapture models (Karanth and Nichols, 1998) and from track plots recording individual tiger pugmarks based on features and measurements. The abundance data collected from the camera-trap for tiger would be compared with the data derived from the track plots for better evaluation of corridors.

2. **Corridor characteristics:** Existing spatial data acquired under Terai Arc Project would be used to prepare maps of identified corridors and patch characteristics (fragmentation, level of disturbance). Adequate nested plots (quadrats) of varying sizes (10m, 5m and 1m for trees, shrubs and herbs associated variables respectively) will be laid on the predetermined transects and information on floristic parameters such as species composition, cover, relative abundance, richness and diversity of ungulate food plants would be quantified in these plots. These transects and plots would also be used for estimating relative abundance of prey species, suitability of habitat for prey, establishing disturbance status and assessment of conservation value.

3. **Socioeconomics:** It would be important to know the human activity and resource use patterns in and around the corridor (5km buffer) areas as these strongly linked with existence of forest and its health. Block and village level developmental initiatives, land use patterns and demographic growth will be ascertained from secondary sources such as the Census Reports, and Forest and Revenue Department records and primary surveys. Further primary data collection enquiring into people attitudes, socio-economic status and market linkages is proposed to be carried out with the help of structured and open ended interview schedule at the village and household level. Resource use details (such as collection of timber, firewood, fodder and grazing) would be quantified in the field and correlation analyses would be done with the data from the survey.

Quality of the patches connected by corridors of interest will also be assessed using methods described for corridor assessment.

Project would be carried out by Mr. K. Rajapandian, with the supervision of Dr. A.J.T. Johnsingh, Dr. S.P. Goyal, Mr. Qamar Qureshi and Dr. G.S. Rawat

Management Implications

Forest Department and local NGOs are the relevant agencies that can potentially implement the project outcome. Therefore, the results (both spatial in the form of map and aspatial data) obtained from the present project will be made available to the respective Forest Departments and local NGOs. The results would enable these agencies to focus on the specific issues that would augment the favorable conditions and eliminate the impediments in the connectivity.

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Budget Category	Amount Requested (US $)			
	I Year	II Year	III Year	Total
Salaries and Benefits				
Salaries				
1 Research Fellow @ 200 US $/month	2400	2400	2400	7200
1 Technical Assistant @ 150 US $/month	-	1800	900	2700
2 Field Assistants @ 75 US $/month	1800	1800	-	3600
Casual labors : 200 labors/year @ 2 US $/day	400	400	-	800
1 Driver @ 130 US $/month	1560	1560	1560	4680
Benefits				
Insurance for the project team (4 persons in the first year and 5 persons in the second year @ 40 US $/person/year)	160	200	-	360
Other				
Travel				
Vehicle maintenance and fuel	2750	2750	-	5500
Headquarters (WII) to study sites by road using existing four-wheeler for the researchers and field staffs and 10 trips/year @150 US $/trip	1500	1500	-	3000
Headquarters (WII) to study sites by road (using a four-wheeler) for the Principal Investigators and 2 trips/year @250 US $/trip	500	500	-	1000
Supplies and materials				
Base-camp establishment	200	-	-	200
Camera 35mm SLR (50mm, 300mm lens)	900	-	-	900
Film (including film rolls for camera-traps, processing of film rolls, batteries for camera-traps and GPS etc.)	600	600	-	1200
Stationery (office stationery etc.)	100	100	100	300
Report preparation	-	-	1300	1300
Telephone, fax, e-mail and others	100	100	100	300
Photocopying	75	75	150	300
Dress allowance for the project team (5 persons) and other field equipments	160	200	-	360
Book allowance	75	75	150	300
Total	**13280**	**14060**	**6660**	**34000**

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